IBM FlashSystem 840 Product Guide
IBM Redbooks Product Guide

This IBM® Redbooks® Product Guide describes IBM FlashSystem™ 840. Today's global organizations depend upon the ability to unlock business insights from massive volumes of data, and they need to be able to do it faster than the competition. Flash technology has changed the economics of today's data center by eliminating storage bottlenecks. Flash technology has redefined the performance, efficiency, and reliability of data-intensive applications. In fact, IBM flash storage offerings provide extreme input/output operations per second (IOPS) performance in a power-efficient footprint.

FlashSystem 840 is optimized for the data center to enable organizations of all sizes to strategically harness the value of stored data. IBM FlashSystem 840 delivers a competitive advantage for the modern organizations and enterprises. It provides flexible capacity and extreme performance for the most demanding applications, including virtualized or bare-metal online transaction processing (OLTP) and online analytical processing (OLAP) databases, virtual desktop infrastructures (VDI), technical computing applications, and cloud environments. The system accelerates response times with IBM MicroLatency™ access times as low as 90 µs write latency and 135 µs read latency to enable faster decision making.

The introduction of a low capacity 1 TB flash module allows FlashSystem 840 to be configured in capacity points as low as 2 TB in protected RAID 5 mode. Coupled with 10 GB iSCSI, FlashSystem is positioned to bring extreme performance to small and medium sized businesses (SMB) and growth markets. Figure 1 shows FlashSystem 840.

Figure 1. FlashSystem 840

Did you know?

- FlashSystem 840 is configurable with 2 - 48 TB of usable capacity for increased flexibility.
- FlashSystem 840 provides four flexible interface types including Fibre Channel, Fibre Channel over Ethernet (FCoE), iSCSI, and InfiniBand to easily integrate into existing SAN environments.
- FlashSystem 840 is cloud-optimized with support for 10 Gbit iSCSI interfaces, allowing private cloud environments and Managed Service Providers (MSPs) to take advantage of high-performance storage inside existing Ethernet-based infrastructures.
- All active parts are hot-swappable, including the flash modules.

Key features

FlashSystem 840 provides extreme performance, enterprise-class reliability, energy efficiency, and optional data-at-rest encryption.

Scalability and performance

FlashSystem 840 has the following scalability and performance features:

- IBM MicroLatency provides latency that is measured in microseconds
- High aggregate performance (bandwidth) and IOPS (I/Os per second)
- Two hot-swappable canisters, providing connectivity to the host
- Flexible interface types of Fibre Channel, Fibre Channel over Ethernet (FCoE), iSCSI and InfiniBand
  - o Up to 16 ports of 8 Gbps or eight ports of 16 Gbps Fibre Channel
  - o Up to 16 ports of 10 Gbps FCoE
  - o Up to 16 ports of 10 Gbps iSCSI
  - o Up to eight ports of 40 Gbps quad data rate (QDR) InfiniBand
- Slots for up to 12 hot-swappable flash storage modules (1 TB, 2 TB or 4 TB modules)
- Configurable 2 - 48 TB of capacity for increased flexibility

Reliability, availability, and serviceability

FlashSystem 840 storage products deliver the following enterprise-class reliability features:

- Concurrent code load enables customer applications to remain online during firmware upgrades to all components, including the flash modules.

- Hot-swappable flash modules by way of tool-less front panel access. If a flash module failure occurs, critical customer applications can remain online while the defective module is replaced.

- Redundant hot-swappable components. RAID controllers, management modules, interface cards (all contained in the canister), batteries, fans, and power supplies are all redundant and hot-swappable. All components are easily accessible through the front or rear of the enclosure, so IBM FlashSystem 840 does not need to be moved in the rack and no top access panels or cables need to be extended.

- RAID 0 and RAID 5 configurations for reliability that suits varying client needs.

  As of FlashSystem 840 release 1.3, before enabling RAID 0, you must submit a Solution for Compliance in a Regulated Environment (SCORE)/request for price quotation (RPQ).To submit a SCORE/RPQ, contact your IBM representative.

- System-wide RAID 5 with easily accessed front-loadable hot-swappable flash modules to help prevent data loss and improve availability.

- IBM Variable Stripe RAID™ (VSR), which is a patented IBM technology that provides an intra-module RAID stripe on each flash module.

- Two-dimensional (2D) Flash RAID, which consists of IBM Variable Stripe RAID and system-wide RAID 5. Variable Stripe RAID technology helps reduce downtime and maintain performance and capacity in the event of partial or full flash chip failures. System-wide RAID 5, with easily accessed hot swappable flash modules, helps prevent data loss and promote availability.

- Flash Cell leveling, which is a technology that reduces flash cell wear because of electrical programming.

Energy and space efficiency

FlashSystem 840 has the following features:

- The new 1300W power supply, feature AF1H, for high-line voltage provides IBM FlashSystem 840 with a high-power alternative to run at maximum performance for longer durations during power supply servicing, resulting in more predictable performance under unexpected failure conditions. The maximum and minimum voltage ranges (Vrms) and associated high line AC Ranges are specified below:

  Minimum-180V, Nominal- 200V-240V, Maximum-265V

  Notes:
    o   The two power supplies must be matched; you cannot have one 900W and one 1300W power supply.
    o   It is recommended that the two power supplies are placed on different circuits.

- The 900W power supply, feature AF1M, Standard Power Supply has nominal 625 W power consumption (for a 70/30 read/write workload on an eight module, 2 TB FlashSystem), and uses two standard, single-phase (100 v - 240 v) electrical outlets.

- Space-efficient 2U form factor that is ideally suited for today's data centers.

Battery Reconditioning

This release enables a battery reconditioning feature that calibrates the gauge that reports the amount of charge on the batteries. On systems that have been installed for 10 months or more, or systems that have experienced several power outages, the recommendation to run "battery reconditioning" will appear in the Event Log shortly after upgrading. Refer to version 1.3 of the FlashSystem Knowledge Center for more information:
 http://ibm.co/1o0Z8br

Manageability and security

FlashSystem 840 offers the following manageability and security features:

- Advanced security for data at rest with hardware-accelerated AES-XTS 256 bit encryption

- Graphical user interface (GUI) and command-line interface (CLI) based on IBM SAN Volume Controller, which is available in any supported browser

- SAN Volume Controller CLI

- Simple Network Management Protocol (SNMP)

- Email alerts

- Syslog redirect to send system log messages to another host

Architecture and key components

IBM FlashSystem 840 enclosures consist of two fully redundant canisters. Each canister contains a RAID controller, two interface cards, and a management controller with an associated 1 Gbps Ethernet port. Each canister also has a USB port and two hot-swappable fan modules.

In addition to the canisters, IBM FlashSystem 840 enclosures include two battery modules and two power supplies, which are all redundant and hot-swappable. All components are easily accessible by way of the front or rear of the unit, so IBM FlashSystem 840 does not need to be moved in the rack, and any top

access panels or cables do not need to be extended. This makes servicing the unit easy.

The front of the enclosure has the two battery modules on the far left of the enclosure and twelve flash module slots to the right of the battery modules, as shown in Figure 2.
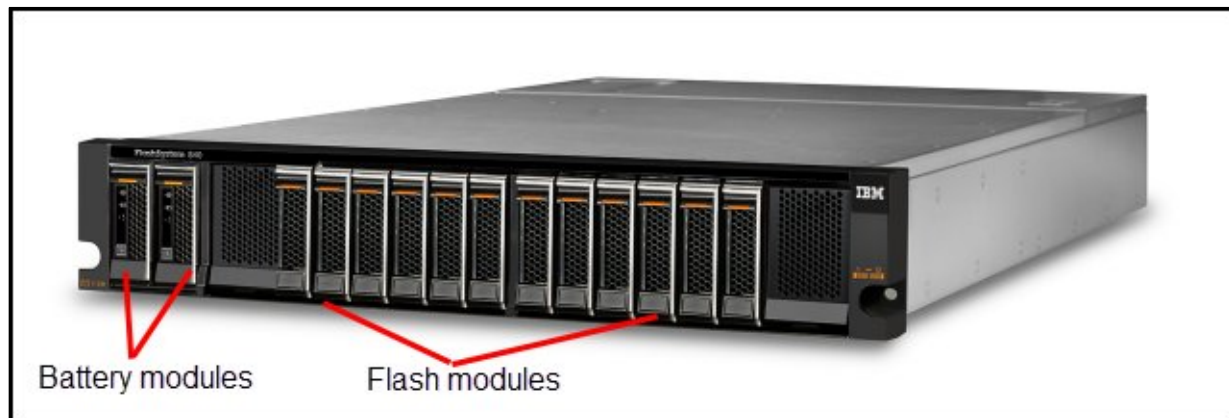

Figure 2. Front view of FlashSystem 840

Figure 3 shows the components of IBM FlashSystem 840 from the rear. One of the two canisters is removed, and you see two interface cards and two fan modules. The power supply unit to the right of the fans provides redundant power to the system. All components are concurrently maintainable except for the midplane, enclosure LED board, and power interposer board. All external connections are from the rear of the system.
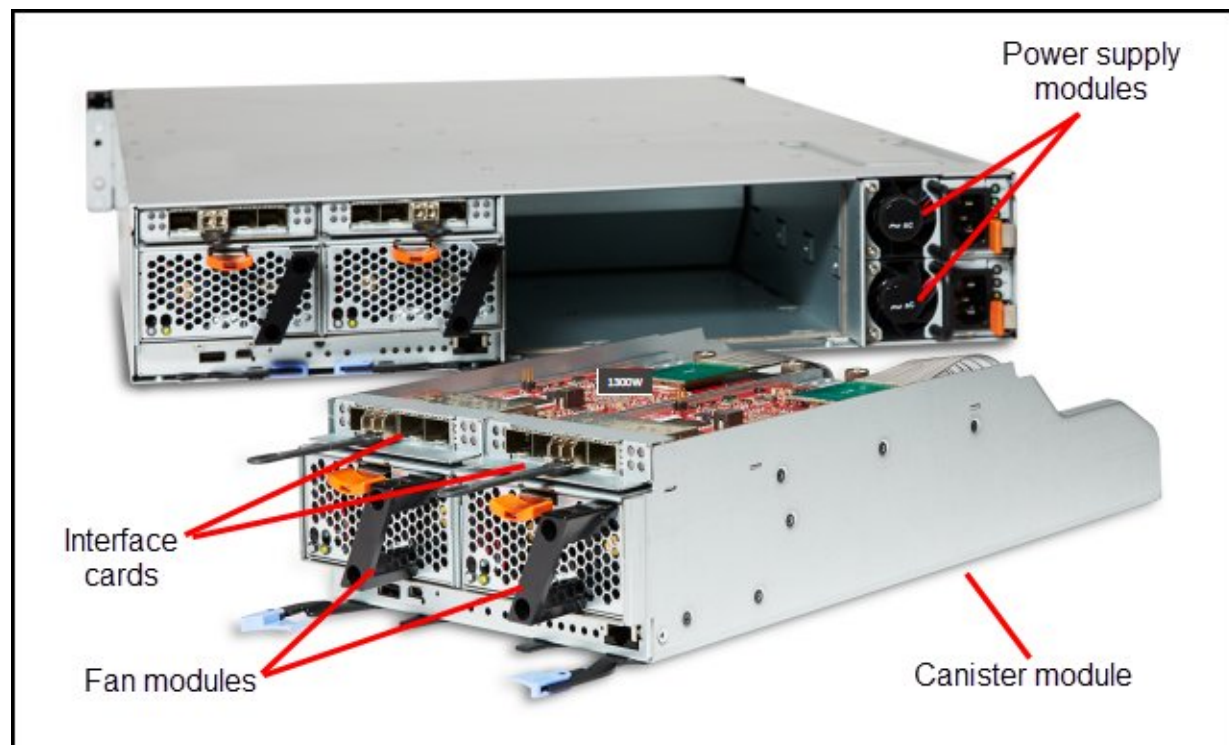

Figure 3. Rear view of FlashSystem 840 with one canister removed

FlashSystem 840 contains two canisters. Each canister contains a RAID controller, two interface cards, and a management controller with an associated Ethernet port and a USB connector.

Figure 4 shows a rear view of FlashSystem 840 with Fibre Channel (FC) or Fibre Channel over Ethernet (FCoE) interfaces. The canisters are to the left (large units) and the two power supply units are to the right (small units).

Figure 4. Rear view with Fibre Channel interface cards

Specifications

Table 1 lists the specifications for FlashSystem 840.

Table 1. Specifications (part 1 of 2)

Specification	Description
Model	9840-AE1, 9843-AE1.
Form factor	2U rack-mounted enclosure.
Flash module quantity	Up to 12 flash modules in increments of 2, 4, 6, 8, 10, or 12. These modules can be either 1 TB, 2 TB, or 4 TB and cannot be intermixed.
Flash type	Enterprise multilevel cell (eMLC).
Raw capacity (TB/TiB)	2.75 TB/2.5 TiB, 5.5 TB/5 TiB, 8.25 TB/7.5 TiB, 11 TB/10 TiB, 16.5 TB/15 TiB, 22 TB/20 TiB, 27.5 TB/25 TiB, 33 TB/30 TiB, 44 TB/40 TiB, 55 TB/50 TiB, 66 TB/60 TiB.
RAID 0 usable capacity (TB/TiB) a	2 TB/1.88 TiB, 4 TB/3.75 TiB, 6 TB/5.63 TiB, 8 TB/7.5 TiB, 10 TB/9.34 TiB, 12 TB/11.25 TiB, 16 TB/15 TiB, 20 TB/ 18.75 TiB, 24 TB/22.25 TiB, 32 TB/30 TiB, 40 TB/37.5 TiB and 48 TB/45 TiB.
RAID 5 usable capacity (TB/TiB)	2 TB/1.88 TiB, 4 TB/3.75 TiB, 6 TB/5.63 TiB, 8 TB/7.5 TiB, 10 TB/9.34 TiB, 12 TB/11.25 TiB, 16 TB/15 TiB, 20 TB/ 18.75 TiB, 24 TB/22.25 TiB, 32 TB/30 TiB, and 40 TB/37.5 TiB..
Maximum capacity	For RAID 0, the maximum capacity is 48 TB. For RAID 5, the maximum capacity is 40 TB.
Flash module protection	ECC error correction, Variable stripe RAID data protection, overprovisioning, and IBM two-dimensional Flash RAID.
RAID support	RAID 0 and RAID 5.
Host interfaces	Two RJ45 Ethernet connections for management and up to 16 host interface connections, which are either SFP+ FC or QSFP InfiniBand connections, depending on the selected features.
Maximum bandwidth	8 GBps Read (100%, sequential), 4 GBps Write (100%, sequential).
Read IOPS	1,100,000.
Write IOPS	600,000.
Read latency	135 µs.
Write latency	90 µs.
Maximum volume support (LUNs)	2 K (2048).
System management	o IBM SAN Volume Controller GUI is available in any supported browser. o IBM SAN Volume Controller CLI. o SNMP. o Email alerts. o Syslog redirect.
Cooling	Four hot-swappable fan modules.

Table 1. Specifications (part 1 of 2)

Specification Description	
Power supply	1300 watts, high-power alternative to run at maximum performance for longer durations during power supply servicing. Two redundant hot-swap 200 - 240V AC auto-sensing power supplies.
Input power	900 watts
Heat dissipation	Approximately 2133 BTU. For maximum configurations, it could go as high as 3753 BTU (maximum configuration RAID 5).
Hot-swap parts	All active components.
Security features	AES-XTS 256 bit data-at-rest encryption with local key management.
Platforms supported	For specific information, see the IBM System Storage Interoperation Center (SSIC) at http://www.ibm.com/systems/support/storage/ssic/interoperability.wss

Warranty	Set of Machine Types in AAS, 24 X 7 Service level Agreement, 4 hour response time:
	  o 9840-AE1 - One year.
	  o 9843-AE1 - Three years.

Service and support	Optional warranty service upgrades and post-warranty services are available on site with 24x7 2-hour, 24x7, or 9x5 same day, or 9x5 next business day response,
Dimensions	Width: 445 mm (17.5 in.) (19-inch Rack Standard) Depth: 761 mm (29.96 in.) Height: 86.2 mm (3.39 in.)

a. As of FlashSystem 840 release 1.3, before enabling RAID 0, you must submit a SCORE/RPQ to IBM. To submit a SCORE/RPQ, contact your IBM representative

Models

The following set of Machine Types are supported in AAS as follows:

- 9840-AE1 - Warranty period 1 year
- 9843-AE1 - Warranty period 3 years

All FlashSystem 840 storage systems ship with the backup batteries, flash modules and blanks, power supplies, fans, and canisters preinstalled. (The flash module type and quantity and the host interface I/O cards must be pre-specified.)

The following items are also shipped with FlashSystem 840:

- System chassis
- Rack rail kit
- Warranty documentation
- Printed quick start guide
- Selected power cables
- Selected interface cables (if any)

Interface cards

IBM FlashSystem 840 supports only one interface type per system. For example, it is not possible to use two Fibre Channel interface cards and two InfiniBand interface cards in the same enclosure.

Interface cards are sold in groups of four for a total of eight or 16 ports for each system.

IBM FlashSystem 840 supports the following interface protocols and number of connections:

- Fibre Channel (16 ports of 8 Gbps; these ports also support 4 Gbps)
- Fibre Channel (eight ports of 16 Gbps; these ports also support 8 Gbps and 4 Gbps)
- Fibre Channel over Ethernet (FCoE) (16 ports of 10 Gbps FCoE)
- Internet Small Computer System Interface (iSCSI) (16 ports of 10 Gbps iSCSI)
- InfiniBand (eight ports of QDR InfiniBand 40 Gbps)

Fibre Channel support

Fibre Channel and Fibre Channel over Ethernet (FCoE) protocols use the same interface cards. However, only one protocol is supported per IBM FlashSystem 840 enclosure. Figure 5 shows the Fibre Channel interface card.
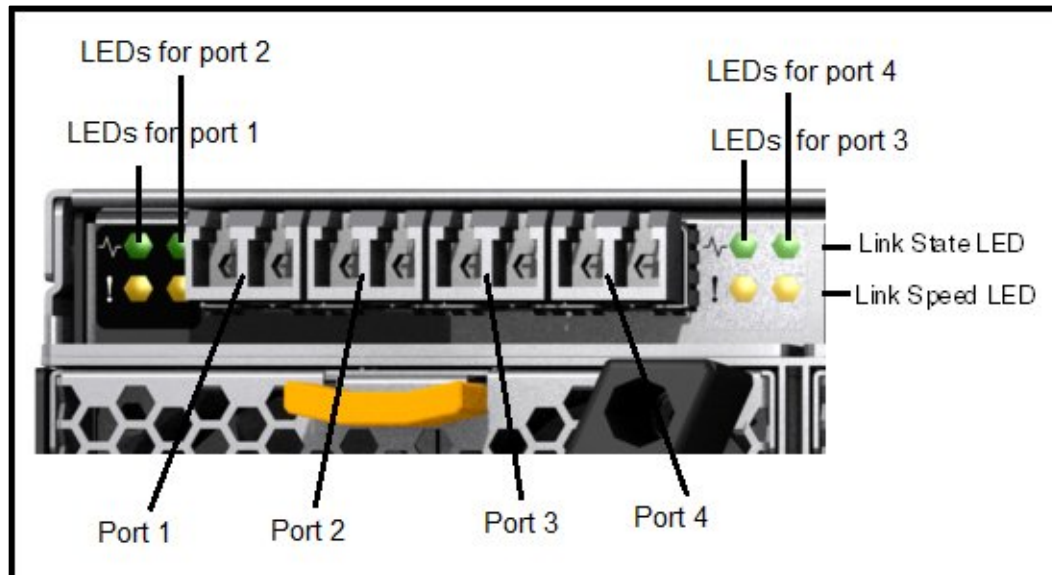

Figure 5. Fibre Channel interface card

IBM FlashSystem 840 supports the 16 Gbps Fibre Channel connection speed through the standard Fibre Channel interface card.

Here are the rules for supporting 16 Gbps Fibre Channel on IBM FlashSystem 840:

- If you use 16 Gbps Fibre Channel, only two (of the four) ports on the Fibre Channel modules can be used. The two left-most ports (1 and 2) on each interface card are used for 16 Gbps support. If your system is configured for 16 Gbps Fibre Channel, only the 2 left-most ports (1 and 2) per interface adapter are used. The other two ports are disabled.

- If you use 16 Gbps Fibre Channel, all four of the Fibre Channel modules are configured for 16 Gbps. This configuration supports a total of eight Fibre Channel ports for the system (2 ports x 4 interface cards).

- Four Gbps and 8 Gbps Fibre Channel connections are supported on the same system connecting to 16 Gbps devices, but there are still only a total of eight available active ports (ports 1 and 2 on each interface card). For example, an IBM FlashSystem 840 system can have four Fibre Channel connections at 16 Gbps and four Fibre Channel connections at 8 Gbps.

- Fibre Channel interfaces support Fibre Channel Protocol (FCP) only, with point-to-point (FC-P2P), arbitrated loop (FC-AL), and switched fabric (FC-SW) topologies. FC interfaces can be configured as N_port or NL_port types. It should be noted that FC-AL is not supported for ports connected at 16 Gbps.

- Full active-active multipathing across all interfaces is supported. Host software support for this function might vary.

Fibre Channel over Ethernet support

FlashSystem 840 supports 16 ports of 10 Gbps Fibre Channel over Ethernet. FCoE uses the same interface cards as FC.

Fibre Channel and FCoE Interface Cards

Each FlashSystem 840 canister supports two Fibre Channel (FC) interface cards for a total of four FC interface cards, 8 Gbps FC cards support four ports, 16 Gbps cards support two ports.

Table 2 shows the supported interface cards.

Table 2. FC/FCoE supported interface cards

Item	Feature code	Ports
FC/FCoE Host Interface Card	AF15 Corequisites: AF18, AF19, or AF1A	-Up to 16 ports of 8 Gbps Fibre Channel (with AF18) -Up to eight ports of 16 Gbps Fibre Channel (with AF19) -Up to 16 ports of 10 Gbps Fibre Channel over Ethernet (with AF1A)
8 Gb FC 8 Port Host Optics	AF18	Up to 16 ports of 8 Gbps Fibre Channel
16 Gb FC 4 Port Host Optics	AF19	Up to eight ports of 16 Gbps Fibre Channel
10 Gb FCoE 8 Port Host Optics	AF1A	Up to 16 ports of 10 Gbps Fibre Channel over Ethernet

iSCSI interface card

FlashSystem 840 supports 16 ports of 10 Gbps iSCSI for clients looking for alternatives to SANs. The iSCSI interface card looks similar to the FC/FCoE cards with Fibre optical connections as shown in the previous Figure 5.

Table 3 shows the supported iSCSI interface card and port optics.

Table 3. iSCSI supported interface cards

Item	Feature code	Ports
iSCSI Host Interface Card	AF17 (Corequisite : AF1D)	Up to 16 ports of 10 Gbps iSCSI
10 Gb iSCSI 8 Port Host Optics	AF1D	Up to 16 ports of 10 Gbps iSCSI

InfiniBand interface card

IBM FlashSystem 840 supports four two-port InfiniBand 40 Gbps cards. A total of eight ports of 40 Gbps InfiniBand connections are supported per IBM FlashSystem 840.

IBM FlashSystem 840 InfiniBand cards each have two 4X QDR ports. The InfiniBand card ports can connect to Quad Data Rate (QDR), Double Data Rate (DDR), or Single Data Rate (SDR) InfiniBand HCAs by using the SCSI RDMA Protocol (SRP). IBM FlashSystem 840 InfiniBand interfaces support SCSI RDMA Protocol (SRP) only.

Table 4 lists the supported InfiniBand interface card.

Table 4. Supported InfiniBand interface card

Item	Feature code	Ports
QDR IB 4 Port Host Interface Card	AF16	Eight ports of 40 Gbps QDR InfiniBand

Flash modules

FlashSystem 840 provides configurable flash module capacity. All modules are hot-swappable.

FlashSystem 840 can be populated with up to 12 flash modules in increments of 2, 4, 6, 8,10, or 12. These modules can be either 1 TB, 2 TB, or 4 TB and cannot be intermixed. Capacity can be upgraded by purchasing the AF1B (1 TB), AF10 (2 TB), or AF11 (4 TB) flash module feature codes as MES upgrades. Here are the upgrade paths:

- Using AF1B (1 TB)
  - RAID 0: Start with 2 TB and grow to 4 TB, 6 TB, 8 TB, 10 TB or 12 TB.
  - RAID 5: Start with 2 TB and grow to 4 TB, 6 TB, 8 TB, 10 TB.
- Using AF10 (2 TB)
  - RAID 0: Start with 4 TB and grow to 8 TB, 16 TB, or 24 TB.
  - RAID 5: Start with 4 TB and grow to 12 TB or 20 TB.
- Using AF11 (4 TB)
  - RAID 0: Start with 32 TB and grow to 48 TB.
  - RAID 5: Start with 8 TB and grow to 24 TB or 40 TB.

Table 5 lists the supported flash modules.

Table 5. Supported flash modules

Description	Feature code	Maximum quantity supported
1 TB eMLC Flash Module	AF1B	12
2 TB eMLC Flash Module	AF10	12
4 TB eMLC Flash Module	AF11	12

For RAID 0, these configurations have capacity points of 2 TB, 4 TB, 6 TB, 8 TB, 10 TB, 12 TB, 16 TB, 20 TB, 24 TB, 32 TB, 40 TB, and 48 TB.

For RAID 5, these configurations have capacity points of 2 TB, 4 TB, 6 TB, 8 TB, 10 TB, 12 TB, 16 TB, 20 TB, 24 TB, 32 TB, and 40 TB.

IBM Variable Stripe RAID

Variable Stripe RAID data protection is a unique, self-healing data protection that is managed independently by each flash controller on each flash module. With Variable Stripe RAID, every flash controller creates a striped data layout across its set of 10 chips similar to a 9+1 RAID 5 array with rotating parity. The Variable Stripe RAID stripe (page) size is 4 KB. When the Variable Stripe RAID algorithm detects a failure affecting one or more flash module in a RAID stripe, the following process happens:

1. Data that is stored in the affected regions is reconstructed from the remaining data/parity elements in the stripe.

2. All pages in the affected stripe, including the reconstructed data, are moved to reserved space (overprovisioned area).

3. Subsequent requests for data in the affected stripe are directed to the new locations (now part of the normal storage area in the system).

4. The original location of the affected stripe is added to the available overprovisioned area as a (n-1) + parity stripe. (For example, if the affected stripe was a 9+1 stripe, it becomes an 8+1 stripe.).

No system-level rebuild process is necessary to maintain data protection or usable capacity after a failure caught by Variable Stripe RAID. Further more, the entire Variable Stripe RAID recovery process is automatic and transparent to the user and administrator, and typically takes place in less than a second. Variable Stripe RAID activities are not normally tracked in system logs, but the root causes of failures that are typically handled by Variable Stripe RAID-plane failures and block failures are tracked in system counters and reflected in the overall flash module and system health metrics.

IBM Two-dimensional (2D) Flash RAID

The combination of IBM Variable Stripe RAID and system-level RAID 5 protection across flash modules is called two-dimensional (2D) Flash RAID. Variable Stripe RAID automatically and transparently protects against partial or full flash chip failures within the flash module, with no downtime or maintenance required. System-level RAID 5 adds protection against complete flash module failure and enables hot-swappable flash modules. Additionally, all active components are redundant and hot-swappable with tool-less access from the front or back of the system, enhancing two-dimensional RAID protection.

RAID 5 and RAID 0 support

In RAID 5 or RAID 0 modes, up to 2048 logical volumes (sometimes referred to as LUNs) can be created in the system, with a minimum size of 1 MB and a maximum size of the full available system capacity. In RAID 0, failures of single flash modules containing data compromise system data integrity for logical volumes that are stored on those flash modules. Under the direction of the management module, RAID module field-programmable gate arrays (FPGAs) can coordinate data transfer between modules, for example, to rebuild the system-level RAID 5 data layout, if RAID 5 mode is active.

Note: As of FlashSystem 840 release 1.3, before enabling RAID 0, you must submit a SCORE/RPQ to IBM. To submit a SCORE/RPQ, contact your IBM representative.

Scalable configurations

FlashSystem 840 can scale usable capacity from as low as 2 TB to as high as 48 TB in its compact 2U enclosure. With FlashSystem 840, many granular capacity points are possible due to the three choices in flash module capacity: 1 TB, 2 TB, and 4 TB. Flash modules can be added so that IT personnel can expand capacity to support changing needs for organizations and enterprises of all sizes. Capacity expansion does however require reformat of existing RAID 0 or RAID 5 arrays to include the new flash modules.

FlashSystem 840 supports the RAID 0 configurations with the latest capacity points with the addition of 1 TB flash module listed in Table 6.

Table 6. Supported FlashSystem RAID 0 configurations with latest FlashSystem 840 capacity points

Capacity Selection (in TB)	FlashSystem 840 initial release	FlashSystem 840 current release
2		2 X 1 TB
4	2 X 2TB	4 X 1 TB
6		6 X 1 TB
8	4 X 2 TB	8 X 1 TB
10		10 X 1 TB
12		12 X 1 TB
16	8 X 2 TB	8 X 2 TB
20		10 X 2 TB
24	12 X 2 TB	12 X 2 TB
32	8 X 4 TB	8 X 4 TB
40		10 X 4 TB
48	12 X 4 TB	12 X 4 TB

RAID 0 configurations provide a high degree of capacity utilization because no flash modules are used for either spare or parity. Data protection is provided by Variable Stripe RAID, however data is not protected against flash module failure.

FlashSystem 840 supports the RAID 5 configurations with the latest capacity points with the addition of 1 TB modules listed in Table 7.

Table 7. Supported FlashSystem RAID 5 configurations with latest FlashSystem 840 capacity points

Capacity Selection (in TB)	FlashSystem 840 initial release	FlashSystem 840 current release
2		4 X 1 TB
4	4 X 2TB	6 X 1 TB
6		8 X 1 TB
8	4 X 4 TB	10 X 1 TB
10		12 X 1 TB
12	8 X 2 TB	8 X 2 TB
16		10 X 2 TB
20	12 X 2 TB	12 X 2 TB
24	8 X 4 TB	8 X 4 TB
32		10 X 4 TB
40	12 X 4 TB	12 X 4 TB

RAID 5 configurations provide a high degree of redundancy with Variable Stripe RAID as well as a RAID 5 protection. RAID 5 data protection includes two flash modules dedicated as parity and hot spare.

Small or large RAID 5 configurations

The cost of using RAID 5 as compared to RAID 0 is capacity. A RAID 5 configuration uses one flash module as parity and one flash module as spare. Maximum capacity utilization for RAID 5 is provided using 12 flash modules.

Depending on client needs, and if capacity expansion is expected over time, clients may consider initial RAID 5 configurations with 12 flash modules which provides the least capacity penalty for RAID 5 protection. In comparison small configurations using only four flash modules configured in RAID 5 cost half of the total capacity reserved for redundancy.

Note: Different flash module sizes cannot be intermixed in the same IBM FlashSystem 840 chassis.

Network cables

FlashSystem 840 supports the network cables that are listed in Table 8.

Table 8. Supported network cables

Description	Feature code	Maximum quantity supported
Fibre Channel cables (supported on Fibre Channel ports)		
1 m Fiber Cable (LC-LC)	3700	16
5 m Fiber Cable (LC-LC)	3701	16
InfiniBand cables (supported on InfiniBand ports)		
1 m IBM QSFP Cop IB	A0RD	8
3 m IBM QSFP Cop IB	A0RE	8
3 m IBM QSFP Opt QDR IB	5989	8
10 m IBM QSFP Opt QDR IB	5990	8
1 m Mlnx QSFP Cop FDR14 IB	A2YG	8
3 m Mlnx QSFP Cop FDR14 IB	A2YH	8
3 m Mlnx QSFP Opt FDR14 IB	A2YL	8
10 m Mlnx QSFP Opt FDR14 IB	A2YN	8
Power supplies		
1300W Power Supply for High Line Voltage, MT 9840/43 AE1	AF1H	2
900W Standard Power Supply, MT 9840/43 AE1	AF1M	2

Encryption

FlashSystem 840 storage system provides support for AES-XTS 256 bit data-at-rest encryption when the Encryption Enablement Pack, feature AF14, is ordered.

In addition FlashSystem 840 has the following functions

- Hot Encryption Activation - Adding an encryption license to a previously initialized system
- Encryption Re-key - Changing the encryption key on a previously initialized system

Both of these operations can be done concurrently and do not cause loss of access to data. Both operations do require that you purchase the Feature Code AF14: Encryption Enablement Pack.

It is recommended that if you are planning to implement either Hot Encryption Activation or Encryption Re-key, that you inform IBM support so they can monitor the operation

For more information refer to the FlashSystem Knowledge Center version 1.3:
 http://ibm.co/1o0Z8br

System management

The management modules in FlashSystem 840 storage system are processor complexes in the canisters. The management modules are configured for active-passive redundancy. The management modules run a highly customized Linux-based operating system that coordinates and monitors all significant functions in the system.

The management modules provide a Java based web interface, Secure Shell (SSH) access, and SNMP connectivity through external Ethernet interfaces. The web and SSH interfaces allow administrators to monitor system performance and health metrics, configure storage, and collect support data, among other features.

IBM FlashSystem 840 includes the usage of the common IBM SAN Volume Controller CLI and the IBM SAN Volume Controller GUI, which is based on the IBM XIV® GUI. IBM FlashSystem 840 supports SNMP, email forwarding (SMTP), and syslog redirection for complete enterprise management access.

The storage configuration includes defining logical units with capacities, access policies, and other parameters. No software needs to be installed on host computers to administer FlashSystem 840 beyond a web browser with Java support or a standard SSH client.

Web interface

Navigating the management tool is simple. You can hover the cursor over one of the five function icons on the left side of the window, which highlights the function icon and shows a list of options. You can then move the cursor to the wanted option and click it. The GUI has three main sections for navigating through the management tool:

- Function Icons (left side)
- Status bars (bottom)
- Actions menu (upper left, or right-click the home page)

To the right of the upper middle of the GUI is the function key for managing the security of the user that is logged in. In the upper right corner is the Help button, which provides information about licenses and gives access to the FlashSystem 840 information center.

On the far left of the window are five function icons:

- The Monitoring menu
- The Volumes menu
- The Hosts menu
- The Access menu
- The Settings menu

At the bottom of the window are three status indicators. These indicators provide information about capacity usage, throughput in megabytes per second (MBps), IOPS, and the health status of the system.

The management GUI is the primary tool to manage the system. Figure 6 shows the management GUI and the associated menu options.
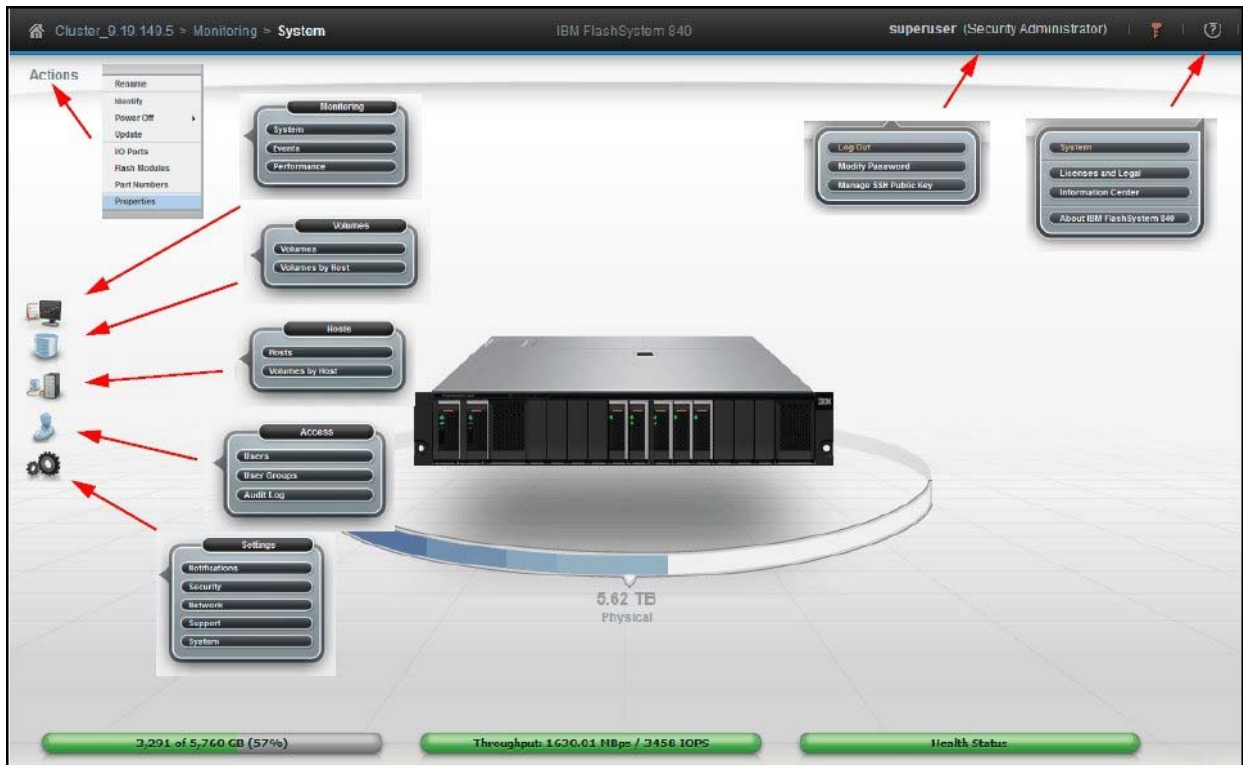

Figure 6. IBM FlashSystem 840 Management GUI

As of release 1.3, additional FlashSystem 840 management software improvements make system management and performance health monitoring even more effective in FlashSystem's already intuitive GUI. Additional features include:

- Three hundred days of performance data with span and zoom capability to better identify and research trends
- Five predefined graphs showing System IOPS, Latency, Bandwidth, Total Port IOPS, and Queue Depth

Performance menu overview

You enter the FlashSystem 840 performance monitor by clicking Monitoring -> Performance. The first time after the browser window is opened system latency is displayed as shown in Figure 7.
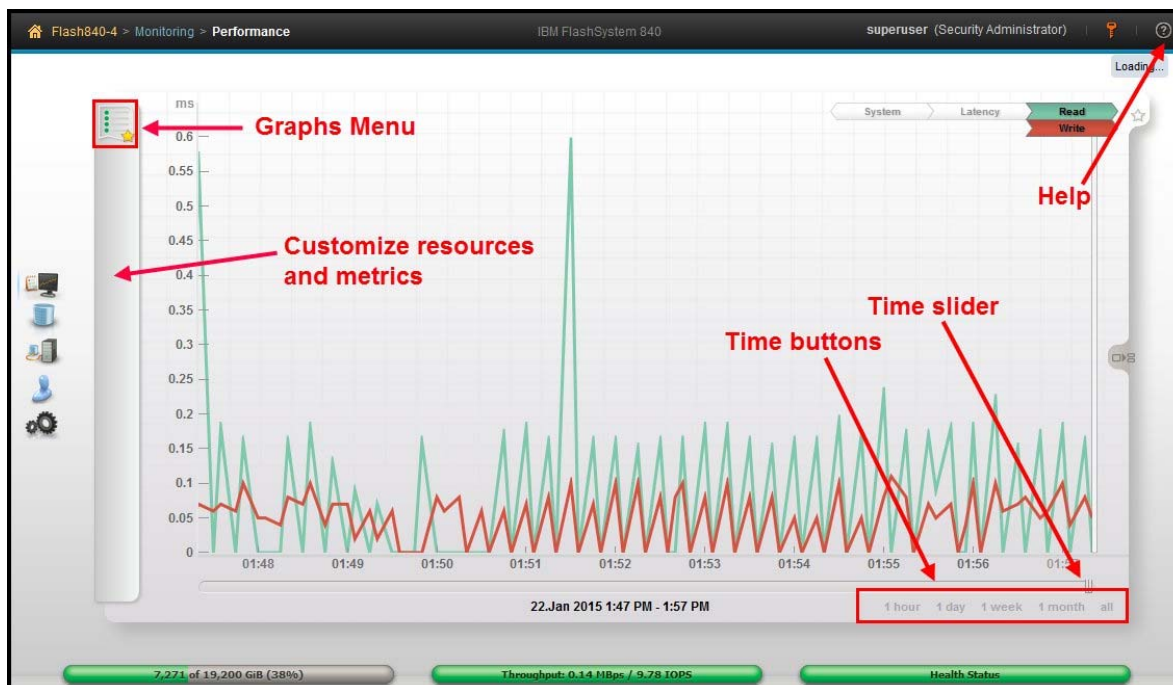
Figure 7. Improved GUI - Performance monitoring default window

The horizontal part of the graph displays the time line. You can slide the time line to view the past. You can also adjust the granularity of the time line by selecting one hour, one day, one week, one month or all. All displays the year to date.

 Five performance charts can be reviewed from the graphs menu:

● System IO:
    The System I/O graph displays the average number of read, write, and total I/O requests per second (IOPS) over the sample period. Each request type (read, write and total) is represented by a different color line.

● System Latency
    The System Latency graph displays the average amount of time in milliseconds (ms) each read and write I/O request takes over the given sampling period. Each request type (read and write) is represented by a different color line.

● System Bandwidth
    The System Bandwidth graph displays the average number of megabytes per second (MBps) of read, write, total and rebuild bandwidth over the sample period. Each bandwidth type (read, write, total, and rebuild) is represented by a different color line. There is one line graph for each system that is selected.

● Interface port Total IOPS
    The Total Port IOPS graph displays average number of read, write, and total I/O requests per second (IOPS) over the sample period. There is one line on the graph for each port in each host adapter in each canister. Each adapter has a different color, and all four ports on an adapter have the same color.

● Interface port Total Queue Depth
    The Total Port Queue Depth graph displays the average number of operations of that type over the sample period. There is one line on the graph for each port in each host adapter in each canister. Each adapter has a different color, and all four ports on an adapter have the same color.

Command-line interface

The CLI provides support for the following tasks:

- Managing users
- Configuring event notifications
- Configuring Call Home
- Configuring network settings
- Configuring hosts interface I/O ports
- Configuring a logical unit (volume)
- Setting access policies
- Backing up configuration settings
- Restoring configuration settings

Supported platforms

IBM FlashSystem 840 supports a wide range of operating systems (Windows Server 2003, 2008, and 2012, Linux, and IBM AIX®), hardware platforms (IBM System x®, IBM Power Systems™, and x86 servers not from IBM), HBAs, and SAN fabrics. For specific information, see the IBM System Storage Interoperation Center (SSIC):

http://www.ibm.com/systems/support/storage/ssic/interoperability.wss

Physical and electrical specifications

FlashSystem 840 has the following physical, electrical, and environmental specifications:

- Dimensions and weight
  - Width: 445 mm (17.5 in.) (19-inch rack standard)
  - Depth: 761 mm (29.96 in.)
  - Height: 86.2 mm (3.39 in.)
  - Weight: 17.69 kg (39 lb)
- Air temperature
  - Operating: Minimum of 5°C (50°F) at 30.5 m below to 3,050 m above sea level (100 ft below to 10,000 ft above); Maximum rated up to 40°C (95°F) at 30.5 m below to 950 m above sea level, de-rated 1°C for each 225 m above 950 m up to 3050 m
  - Non-operating: -10°C to 50°C (14°F to 125°F)
- Relative humidity
  - Operating: 20% - 80%
  - Non-operating: 10% - 90%
- Electrical power
  - Voltage range: 100-240 V AC
  - Frequency: 50 - 60 Hz
- Acoustical noise emission
  - 8.0 bels (idling)
  - 8.0 bels (operating)
- Power consumption
  - 900 watts PSU, 625 watts RAID 5 typical operation, per 2U
  - 1300 watts PSU, 900 watts RAID 5 typical operation, per 2U

Warranty information and upgrades

IBM FlashSystem 840 is shipped with a one-year and a three-year warranty.

Technical Advisor (TA) support is provided during the warranty period. The TA enhances end-to-end support for the client's complex IT solutions. The TA uses an integrated approach for proactive, coordinated cross-team support to allow customers to maximize IT availability. TA support for FlashSystem is delivered remotely and includes a documented support plan, coordinated problem and crisis management, reporting on the client's hardware inventories and microcode levels, and consultation regarding FlashSystem microcode updates. The Technical Advisor conducts a Welcome Call with the client and provides a statement of work for this support.

Flash media within IBM FlashSystem is covered in full for the duration of the warranty and maintenance period. The system is also Energy Star certified.

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Related publications and links

For more information, see these resources:

- *Implementing IBM FlashSystem 840*, SG24-8189
  http://www.redbooks.ibm.com/redpieces/abstracts/sg248189.html?Open

- IBM Redbooks Solution Guides and Product Guides for the IBM FlashSystem family
  http://www.redbooks.ibm.com/redbooks.nsf/searchsite?SearchView&query=flashss

- IBM FlashSystem family product page
  http://www.ibm.com/storage/flash

- IBM FlashSystem 840 Knowledge Center Welcome page
  http://ibm.co/1o0Z8br

- IBM System Storage Interoperation Center (SSIC)
  http://www.ibm.com/systems/support/storage/ssic/interoperability.wss

- IBM Support Portal
  http://ibm.com/support/entry/portal/

- IBM Offering Information page (announcement letters and sales manuals):
  http://www.ibm.com/common/ssi/index.wss?request_locale=en

  On this page, enter **FlashSystem**, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

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